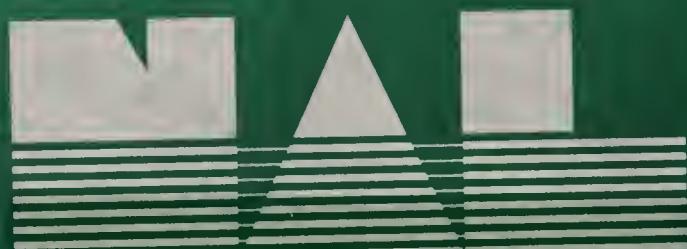


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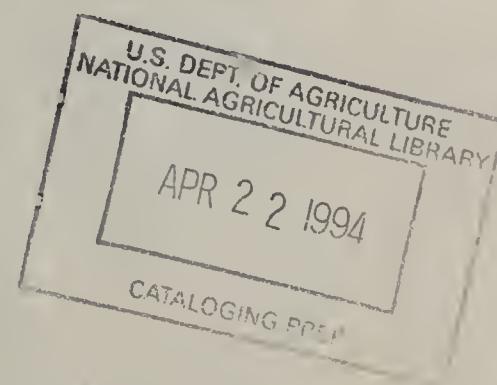
R E P O R T O F P L A N T E X P L O R A T I O N

T O

BELGIAN CONGO, ANGOLA AND SOUTH WEST AFRICA

JANUARY - MAY 1958

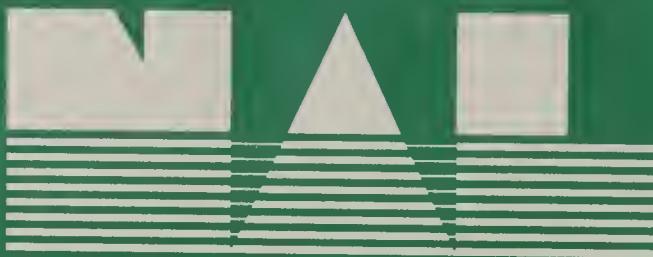
Louis O. Williams and Norris W. Gilbert



United States Department of Agriculture
Agricultural Research Service
Crops Research Division
New Crops Research Branch
Beltsville, Maryland

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TRIP OF PLANT INTRODUCTION SECTION
TO AFRICA - 1958

Members of the Plant Introduction Section's trip to Africa in 1958 were Norris W. Gilbert, agronomist and Louis O. Williams, botanist. The party left Washington on January 20. Gilbert returned to Washington on April 22 and Williams returned on May 5.

During the period of the trip Belgium, Portugal, SénégáI, the Belgian Congo, Ruanda Urundi, Angola, Union of South Africa (en route), South West Africa and Italy (en route) were visited. Border areas, near the Belgian Congo, of the Sudan and Northern Rhodesia were also visited.

The objectives of the trip were two. First to search for and collect living plant material in the form of seeds, cuttings, tubers or other plant parts from wild or cultivated species. Special attention was to potential crops for oilseed, forage, fiber, vegetable or specialty purposes that might be of value to the agriculture of the United States. The second objective was in the nature of reconnaissance, to try to form an opinion of the potentialities of the area covered from point of view of plant introduction.

The list of plants desired out of Africa, by various groups, was a rather extended one. There was special interest in Tephrosia vogelii and many other members of the Leguminosae; in Sansevieria and other plants having fibers; in the wild species of Sesamum for use as genetic material; in certain of the Citrus relatives; there were a few requests for ornamentals; and many other plants.

The trip was successful in that material was secured, often in abundance, of the major desiderata. A fair impression was obtained of much of the country covered.



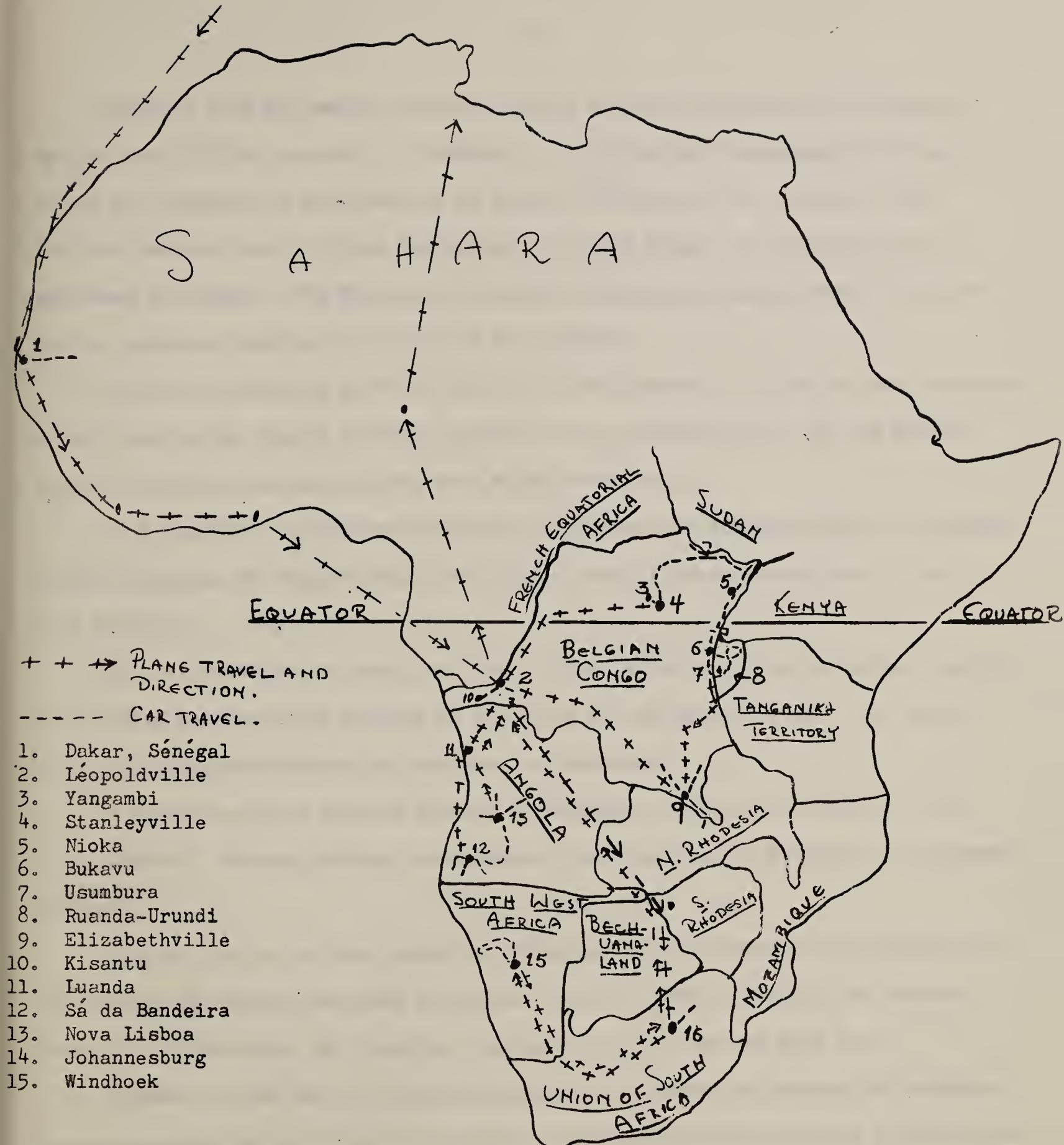
MAP 1. Generalized sketch of the more important phytogeographical regions of the Belgian Congo. We travelled in all of these zones.

1. Savanna, often with scrub forests, gallery forests along streams. It is a southern extension of the Sudanese savanna. Population mostly sparse.
- 1a. Highland savannas, cattle raising, subsistence agriculture; fairly dense

LEGEND FOR MAP 1. (con't)

population in some places but mostly sparse.

2. Region contains areas temperate because of elevation with cloud forests and much area once under cloud forests. Areas at lower elevation are mostly savannas with little rainfall. The region is to us the most important of the Belgian Congo. Dense populations in the mountain area and those of Ruanda-Urundi often over populated.
- 2a. Grassy or Acacia savannas at relatively low elevations.
3. Tropical rain forest, wet the year around but total of rain mostly less than two meters annually. A small climatic change could turn the whole Congo basin area into savanna. Man caused savannas are encroaching from the area marked 'l' into the tropical rain forest area. Population concentrated along rivers and roads, otherwise sparse.
4. Open or closed tropical savannas, gallery forests along streams and in valleys. Rainfall slightly less than in the tropical rain forest of the Congo basin and region with a definite dry season. Much of this savanna may be man-made. Population mostly sparse.
5. Scrub forest or closed savanna. This type vegetation extends south to the Zambezi river or the Kalahari sand velt and west almost to the Atlantic ocean in Angola. This region is very similar in aspect to the scrub forest savannas of south central Brazil. Population concentrated in mining areas, otherwise sparse.



Itinerary of Plant Introduction Section

Trip to Africa - 1958

The first stop was made in Brussels where we first visited Dr. John Kross, Agricultural Officer in the U. S. Embassy. Dr. Kross made appointments for us to see Mr. Grosjean in the Ministry of Foreign Affairs and Mr. Legrand of the Institut National pour l'Etude Agronomique du Congo Belge. We visited the two gentlemen mentioned. The Ministry of Foreign Affairs made appointments for us to see Mr. Henrard, Director, Ministry of the Colonies.

It was quite obvious that the people in the Ministry of Colonies were interested not only in the stated official purpose of the projected visit to the Belgian Congo but also in the persons who were to make the trip.

Dr. Kross told me that the Ministry of Colonies had requested that all persons going officially to Belgian Congo should go by way of Brussels and should visit that Ministry.

While in Brussels we spent some time in the herbarium of the botanical garden where INÉAC personnel are working on the flora of the Belgian Congo. We visited also the Congo Museum which has excellent collections.

In Lisbon we first visited Herbert K. Ferguson, Agricultural Officer at the U. S. Embassy. He had nothing to suggest as for visiting the Ministry for Overseas Portugal.

We spent one day at the Centro de Investigacões das Ferrugens de Cafeeiro, at the Estacão Agronomica Nacional in Oeiras. We were shown around by Dr. Antonio Branquinho d'Oliveira, the director, who spent most of the day with us.

In Dakar we were met by Vice Consul Marcel van Essen and through him arrangements were made for us to meet the people in Agriculture (Direction de l'Agriculture) and to visit the Center for Agronomic Research at Bambe (Centre de Recherches

Agronomiques de Bambey au Sénégal). The research center at Bambey is a fine one and has a staff of capable men. Dr. Bouffil, director of the station, was away but we were shown around by members of the staff.

Bambey is essentially a station for the study of crops suited to relatively dry tropical regions for only that part of Sénégal south of the Gambia enclave receives as much as a meter of rain annually. Great emphasis is placed on peanut varieties and their culture.

After arrival in Léopoldville, Belgian Congo, we went to see Mr. Dwight R. Bishop, Agricultural Officer in the consulate. Mr. Bishop was most helpful to us and continued to be helpful during all the time we were in the Congo and southern Africa. Soon after arrival Mr. Bishop made arrangements for us to meet Mr. G. Couteaux, director of Agriculture, who spent considerable time in showing us places of interest around Léopoldville.

We met the regional director of INÉAC in Léopoldville.

Mr. Bishop took us to Jardin Gillet, at Kisantu, about 125 kilometers from Léopoldville.

The region and the garden were in good condition so we hired a car to return and spent three days collecting in the region and in the garden.

Father Callens is director of the garden and was most kind in permitting us to take seeds or propagating material of things that we wanted. The collection of Sansevieras was of especial interest to us. Several were sent back to Washington.

We went from Léopoldville to Yangambi on the upper Congo River. Yangambi is the principal station of the INÉAC and a large part of the scientific staff, laboratories and agronomic research areas are here. It is a very fine station with

a large and competent staff.

We were met by Dr. R. Germain, formerly director of botanical research but now assistant director of the station and director of research.

Dr. Germain spent considerable time with us and arranged for us to see those parts of the large Yangambi station which were of interest to us with the staff member in charge of the particular unit.

The Yangambi station of INÉAC is without doubt the most important one for research on tropical economic plants in Africa. I know of none anywhere in the tropical world that is so competently managed or so well staffed, or where so much research is being carried on. Animal as well as plant research is carried on.

The Yangambi station is of primary importance to anyone interested in economic plants of the low tropics, here the term "economic plants" is used in its widest sense for included are not only food plants and industrial plants but also forage plants.

Mr. J. Henry, director of the station, and his staff were most congenial and helpful and make a stay at the station not only profitable but enjoyable.

Mr. Louis Liben, one of the botanists at the Yangambi station, who is well acquainted with the savannas and flora of the northeastern Congo accompanied us for about two weeks, from Yangambi to Nioka.

The section of the Congo River basin from Stanleyville to near Buta is in most part covered by rain forest except in areas along or near the road that have been cleared by bush negroes for agriculture. The population is quite dense in some areas, especially near junctions of roads with the rivers. The principal cultivated plants are oil palm, cotton, bananas and manioc. Others are present.

Manioc is spontaneous in almost every clearing in the forest, but as a spontaneous plant does not produce roots of much size. I saw mature seeds on manioc for the first time in my life. Oil palm was being harvested. The heads were mostly 10 to 30 pounds, with the individual fruits also small.

Bambesa. The INÉAC maintains a station at Bambesa where grasses and legumes suited to dry regions are the principal concern. I saw here a new method for the vegetative propagation of coffee. The method has not yet been published by the INÉAC scientists but will be soon. We got quite a lot of seed from this station and vicinity, mostly of legumes and grasses.

Bambesa station is on the edge of the savanna, mostly beyond the edge of the equatorial rain forest.

The region between Bambesa and Niangara is mostly grassy savanna. In the beginning it appears to be man made but further along it seems to be natural savanna. There are ciliar forest along streams and in swales. The agriculture is limited to the forest areas and the margins of it. The savanna areas are almost devoid of people at this time of year for there is no water. When we came out of the equatorial forests to the savanna we came into the end of a prolonged and hard dry season. There had been almost no rain for five months.

Most of the savannas of this region are dominated by Imperata cylindrica, a very poor, fire-resistant grass. There was almost nothing in this region of interest to us and much of the country had been recently fired. Cattle are almost non-existant, probably never many on the savanna even under the best conditions.

The general level of this region is 600 meters. The noontime temperature toward end of dry season (mid-February) will approach 100° F. (38°C.).

Niangara-Magombo-Dungu. This area drained by the Uele River is similar to the savanna region previously described except there is more scrub forest and there is more agriculture of subsistence type. The people seem poorer than those of the same ethnic group in the Congo basin forest. The subsistence crops are principally manioc with plantains, bananas and rarely sorghum.

The INÉAC has a new station at Magombo for study of plants that may be used in this dry region. We visited this station.

Cattle are rare, goats are the commonest of domesticated animals. Hogs are almost completely absent, whether because their food is essentially the same as human food (and thus in competition) or for some other reason is not clear to me.

There are several food plants and fruit trees which should do in the region and improve the diet. Cucurbita pepo and C. maxima were not seen. Buckwheat should grow; improved and dry resistant sorghums should be brought in. Tangerines, avocados, several Lucumas and Mammea americana should do in the forested savanna.

We found a few things of interest to us in this region, but plants that might be more useful in similar dry regions of Latin America than in the United States.

Dungu to Aba. The region is almost entirely savanna, much of it with open scrub forest. Louis Liben, INÉAC botanist who accompanied us, thinks that it would come back to low forest in 20 years if fire could be kept out. We found several things to collect in spite of the dryness of the region.

The Congolese government has set aside a rather large area, as Parc National de la Garamba, which extends from Gangala na Bodio to the Sudanese border. This area is set aside for the preservation of a rare rhinoceros and as an elephant preserve. The negroes have been mostly or all moved out. The area should show

what may happen in the savanna area when fire is controlled over a period of years. We saw areas where forest is quite evidently returning.

Aba to Misa and beyond. The Sudanese savanna starts just north of Aba. The country is relatively flat with fairly dense scrub forest. This scrub contains many species that reach their southern limit along the Congo-Sudan border in this region. The population is sparse. The Congo government has built a passable road for a long distance just inside of the frontier with market areas established at intervals to attract trade and especially to provide a place where the negroes of the region may bring in their cotton.

We collected quite a few things in this region considering dryness of the season.

Aba to Nioka via Aru. The entire region is savanna, covered with scrub forest near Aba but southward the elevation increases and the vegetation is in aspect much like that of the prairies of the western United States or the "campo" of western Minas Gerais. Subsistence agriculture is common and cattle become more and more abundant as elevation increases toward Nioka. The population also increases but the people seem to be extremely poor. Fire was common on the savanna and we saw negroes hunting the animals driven out by fire, with spear and bow and arrows.

It is questionable whether any undisturbed areas remain in this region and the natural vegetation must be largely changed.

There is apparently little in this region of interest to Plant Introduction Section.

Nioka. The INÉAC maintains a large station near Nioka. This is the principal

station for improvement and breeding of cattle. A considerable amount of research has been on cattle for the savanna regions of the tropics. The work is not only important for this region but for similar regions elsewhere in the world.

Coöperating with the cattle improvement scientists are another group of scientists studying the use and improvement of the savannas and pastures. Studies of plant associations of the dry and moist areas in relation to their use by cattle are being carried on.

This station also supports a group working on food plants, especially in selection and experimentation with maize, beans, sorghum, sweetpotatoes, manioc and potatoes.

A forestry program directed toward cultivation of trees for fuel, lumber and other uses in a region fast becoming or already depleted of natural forest is being carried on by Mr. A. Devillé, a capable forester. There are controlled experiments with trees from many regions.

We secured a good number of collections from the station and vicinity. We found seed on cultivated sweetpotatoes, the first time I had ever seen seed on this crop. Seed from two kinds were obtained.

We stayed in the region for 3 days and received much help from Mr. J. Rossignol, director of the station and his staff.

We visited the native market near Nioka and got seed of a few plants of interest. Although the market was large, perhaps more than 2,000 negroes present, the selection of available material was small.

Nioka to Bunia via Fatake. The region covered is a continuation of high savanna. There is a relatively dense population of negroes doing subsistence

agriculture. There are a few large European holdings in the region. Merck has a small plantation of Cinchona in the Ituri hills. Bunia is largely a trading center for the surrounding negro population.

Bunia to Beni and Mutwanga. West of Bunia to Irumu and Komanda the savanna continues and looks to be fine cattle country. A few kilometers south of Komanda to within a few kilometers of Beni there is a good rain forest similar to that of the Congo basin. The region has a rather dense population of pygmy and pygmoid people who have cleared into the forest and carry on some agriculture. The pygmies primarily are nomadic or seminomadic and hunters. We found Tephrosa vogelii frequently for first time on trip. It was cultivated by the pygmies, to be used in fishing. Spontaneous plants at this elevation (about 500 meters) do not seem to occur.

Toward Beni there are large commercial plantings of papaya for the extraction of papain.

Beni to Lubero. South of Beni a few kilometers the elevation of the country increases to approximately 1,800 meters, the general level of the North Kivu country. Savannas cover the slopes up from Beni but as soon as this changes to forest country (or formerly forested country) the mountain area changes to one of dense population and agriculture, sometimes intensive agriculture. Most of the area is below 2,700 meters. There are higher areas but very little below 2,400 meters is not in cultivation or has been in cultivation recently. Butembo is the negro trading center of the region and the only town with a bank in the vicinity. (From Bunia to Goma no banks except this one were noticed.) We found Tephrosa vogelii abundantly for the first time in this region. It is used in erosion

control and in new coffee plantations. It is also spontaneous in the region. As a native or spontaneous plant it seems not to go below 1,500 meters.

Due to intense cultivation of this region there is not much to be collected.

Lubero to Kayna. South of Lubero density of population falls off abruptly. The country is covered with a highland forest, dense but trees mostly not more than 50 feet tall, from near Lubero to within 15-20 km. of Kayna. Leaving the forest area north of Kayna the country soon becomes much drier. We found a great many species of Leguminosae in this region. Tephrosia vogelii is abundant from 2,000 meters down to 1,500 meters. A related species of Tephrosia, T. aequilata, was found in the same region, as well as several other species not closely related to T. vogelii.

Many coffee plantations are being started in this region. Coffea arabica is grown up to 1,800 meters, either with sparse shade or none. There must be hundreds of thousands of acres of potential coffee lands in North Kivu between 1,500 and 1,800 meters. Present drawback is difficult transportation in and out. Coffee labor is about U. S. \$0.30 a day.

Kayna to Rutshuru via Ruindi. South from Kayna the road follows down the North Kivu mountains, similar to the region north of Kayna. From the edge of the escarpment down to and through the Great Rift Valley past Ruindi and almost to Rutshuru is Albert National Park. Collecting, and even leaving the road area is forbidden. The slope into the valley is much drier than the plateau above. There are forage plants of interest. The floor of the valley is savanna used by game. Toward the south of the park, near Rutshuru there is less game use of the savanna and scrub forest is said to be rapidly invading the area.

Around Rutshuru we found quite a number of plants interesting to us.

Rutshuru to Kisenyi. This is a volcanic region with higher rainfall than the North Kivu. Coffee is an important crop (1,200-1,600 m.) and a very heavy crop was on (March 10). We found quite a lot of material of interest to us. Tephrosia vogelii was absent although elevations were correct for spontaneous growth, rain possibly excessive for its growth. Beans (Phaseolus vulgaris) are grown in commerical quantities in the vicinity of Goma and Kisenyi. They are a variegated lot. Several collections were made. The region contains quite a lot of Leguminosae. Most were not ripe and a better time would have been a month or more later (April-May).

Kisenyi to Bukavu. The road passes on the west side of Lake Kivu between these two towns. Air distance is 100 km. and land distance about 230 km.! The elevation varies between 1,500 and 1,800 meters. Much of the area is cultivated, both subsistence and plantation agriculture, but large areas are unoccupied. There were many plants collected and many more that would have been ready a month later. Tephrosia vogelii was occasional, both cultivated and spontaneous, but not abundant until near Bukavu where it is used in coffee plantations. Some apparently natural savannas are north of Bukavu.

Bukavu to Usumbura. The road south from Bukavu goes through hills at about 1,800 meters. There is little natural vegetation left. The land has passed from an agricultural to a pastoral stage.

The slope from the highland down to the Ruzizi Valley had a lot of plants of interest. The Ruzizi River valley (1,000 down to 770 m.) was advanced over the highland in season and we found many things of interest.

Ruanda Urundi. Ruanda Urundi is one of the smaller political entities of Africa, being approximately 380 km. in greatest length and about 220 km. at greatest width. The population consists of about 4 million negroes and 7,000 Europeans. The annual increase of population is 3%. It is a trust territory to Belgium. Europeans may not own land for agricultural purposes. The population is concentrated along the high mountain area of the country where there is probably no natural vegetation left except in limited areas. The whole area except the natural savannas to the north and east was no doubt once covered with cloud forest. There is a strip of fine forest extending from south of Ruhengeri south to about 2° 45" S. lat. and 28° 45" E. long. This will probably no longer exist by 1980.

It is my guess that the people are now near the limit of their potential food supply. It is estimated that the population will reach 8,000,000 by about 1975. With limited and deteriorating agricultural lands it seems more than likely that food for this many people cannot be produced.

Usumbura to Astrida. Soon after leaving Usumbura the road climbs into the hills and remains at 1,500-2,000 meters to Astrida. Most of the country is densely settled and hardly an acre is unused. It is not a useful region for collecting plants.

Rubona. The INÉAC has an excellent station at Rubona. Mr. H. Oldenhove de Guertechin is director and a very capable person. The work at this station is aimed at helping the small farmer with a few acres of land. They hope to maintain and improve the situation of these small land holders. The problem is to find plants which will produce more on less space. Coffee plays an important part in the planning. It is hoped that the land can be used to produce this high value

crop and that income can be used to buy food. Twenty-three thousand metric tons of coffee were exported from Ruanda Urandi in 1957.

We secured seeds of many selected strains of beans and castor beans.

Astrida to Kigali. The region is perhaps 80% pastoral. Population less dense than south of Astrida. Region of little interest except near Kigali where some natural vegetation remains. We got quite a few things here.

Kigali to Gabiro. East of Kigali there are savannas and savanna plants below 1,700 meters. The country soon changes to a pastoral region, above 1,700 meters, that was once forest covered. There is some agriculture but not important relatively. Pastoral lands continue to and around Lake Mohasi and north to the border of Kagera National Park.

A thorn savanna dominates the approaches to Gabiro (administrative village for the park). While northward there are large areas of excellent treeless savanna dominated by a Hyparrhenia.

This region provided us with a few specimens. It would be of interest for forage plants for a tropical savanna region.

A curious situation is attendant to cattle growing in much of Ruanda Urandi. Cattle are often raised as "items of prestige"; the primary purpose of raising them is not as human food. Cattle are rarely eaten by the Ruanda people unless the animal is in a moribund state. The man with the most cattle is considered to be the wealthiest and most important. Cattle are used to trade for women. The large amount of land used for cattle growing might well be put to a more economical use.

Gabiro, Kamagiri, Nyakatale, Chyuru, Kigali to Astrida. The northern part of

this circuit is largely savanna, both open and closed. Cattle are abundant. There is some agriculture in favorable places. There is quite a lot of Chrysanthemum grown for production of pyrethrum. The southern part was previously described.

Astrida to Bukavu. West of Astrida the country is high and rugged. It is a mixed agricultural and pastoral region.

About 35 km. airline west of Astrida or 57 km. by the road an elevation of 2,200-2,300 meters and the cloud forest is reached. The cloud forest is an excellent one but is being cut into for farm land and will not last more than 15-20 years at the present rate of invasion according to INÉAC botanist Michel. The forest extends almost to Dendezi above Lake Kivu.

This region provided a few collections. It might repay collection for ornamentals but other plants of economic interest were few.

The car we had used was returned from Bukavu to Stanleyville.

Bukavu to Elizabethville. We flew from Bukavu to Usumbura to Albertville to Manono to Elizabethville. There was good highland forest on the Mugila Mountains west of Lake Tanganyika but we soon came over scrub forest and savanna of a kind that extends south to the Zambezi and a bit beyond; west to Angola and western Congo.

Elizabethville, the Katanga Region. We hired a car here and spent several days going out on different roads from the town. We did make a fair number of collections in the region. The rainy season was almost at an end. The area would provide more legumes and grass toward the middle or end of April. Most were still immature. We found Sansevierias here for the first time. They were abundant on abandoned termite hills.

All of the region visited around Elizabethville was open woodland, or scrub forest-savanna. There is little variation in it.

Agriculture is restricted to a few small areas. Cattle were not seen although the savannas look like good cattle country. Tsetse flies are in the region. Population is sparse except in the vicinity of the mines. The mines of this region are the easily exploitable wealth of the Congo.

Elizabethville-Leopoldville-Luanda-Angola. The trip made by plane. The vegetation scrub forest savannas and toward the west open savannas with forest along streams and swales. The coastal area north of Luanda is semi-desert.

Luanda to Sá da Bandeira. Trip made by plane. We could not see the land, until the interior of Angola was reached.

Sá da Bandeira. We hired a car and driver and spent several days working out from this town. The region is interesting and we got a fair number of new things. The rainy season was nearly at an end and, as at Elizabethville, more things would have been available in another month, end April or first of May.

The interior of Angola is a series of plateaus, three main ones are at roughly 1,000, 1,500-1,700 and 2,100 meters. The country is sparsely settled except in vicinity of larger towns. There are many more Europeans than in the Congo and there is a very different feeling among them. A Portuguese comes out to Angola and within a month he considers himself an Angolan. (The Belgians in Congo consider themselves Metropolitan Belgians, even if born in Congo.)

The central highlands are cool with occasional frost on the higher mountains and plateaus. There is agriculture and grazing over all of the region that we visited. The lower plateau, 1,000 meters, is rather hot, agriculture is sparse and

most land is used for grazing. The middle plateau about 1,500-1,700 meters; is often a fine agricultural region and the greater part of Angolan population lives here. Much of the middle level is scrub forest savanna, suited best to cattle raising. Many of the same plants from the region of Elizabethville are here.

The high plateau, about 2,100 meters, is limited in area. There is a small amount near Sá da Bandeira and again near Nova Lisboa. It is suited to sheep raising.

Sá da Bandeira-Nova Lisboa via Caconda. Soon after leaving Sá a plateau level of about 1,500 meters is maintained, with minor variation almost to Caconda. The region is largely scrub forest savanna, grazing is prominent in part of the area. Agriculture is not common except in a few more favorable areas.

From Caconda north to Nova Lisboa the plateau is slightly higher, averaging a bit more than 1,550 meters. It is scrub forest savanna. Near Nova Lisboa there is quite a lot of farming, even of wheat.

Nova Lisboa. We worked several days out of Nova Lisboa, one day down to a lower plateau where collecting was good, the season a bit more advanced. Mostly the country is scrub forest savannas, similar to other regions southward.

Angola - potential. There is chance of getting quite a lot of material from Angolan plateaus. Best season April through May. It is likely that there would be a number of good ornamentals found on the high plateau. Succulents on the desert coast probably would be interesting. Travelling on the coast might not be easy.

Nova Lisboa to Léopoldville. We returned by plane to Luanda and Léopoldville. Gilbert returned to the States from Léopoldville and I went down to South West Africa.

Léopoldville-Johannesburg-Windhoek. I flew down to South West Africa to visit

the region of Windhoek and Usakos where four species of Sesamum were said to occur. I found three of these species. In addition a number of other things were collected in the region.

In South West I went to the Department of Agriculture where I received considerable help from the director, Dr. James Watts and from the botanist, Mr. Bernard de Whinter. Mr. de Whinter accompanied me to the north to Usakos and in several other regions in South West.

South West Africa is pastoral, except for relatively small areas. Agriculture is relatively unimportant in its economy. Water is nowhere available for irrigation except along the Orange River and that area is limited.

Stock raising, sheep, goat, cattle, is carried out all over South West except in the absolute desert regions, such as the Namib Desert that extends along all the coastal region of South West, extending north into Angola and south into the Union of South Africa.

Grazing of sheep is carried on where there are as little as 75 mm. annual rainfall. In all of the region the annual rain fall is rarely more than 350 mm. and cattle operations are quite successful with as little as 200-250 mm. of annual rain. Rather strict regulations are observed to prevent overgrazing of private lands.

Potential of South West Africa. The plants of outstanding interest in South West are the forage plants, principally grasses. These grasses should be collected for trial in our south and southwest. They most certainly would be of importance to the more arid plateau regions of Central Mexico. The time to make collections could be May and June. Further south in March or April and north perhaps extending

into July.

There is potential for ornamentals in much of the region. Especially for succulents along the edge of the Namib desert and actually in the desert. There are reported to be many in the vicinity of Aus. The coastal desert region is mostly controlled by the De Biers Diamond Corporation, from about 23° South latitude south to the Orange River. Travel is restricted.

P L A N T S O F S P E C I A L I N T E R E S T

Arachis: Peanuts are of interest in all parts of Africa where we visited not only for oil but also as a subsistence crop. Many cultivated and selected lines can be had from Sénégal and from INÉAC in Congo. Much interest was shown in the Plant Introduction Section's projected collecting trip to wild peanut country of Brazil. Genetic material will be welcomed.

Aristida: South West Africa is a region on the southwest coast of Africa partly within and partly out of the tropics. The region consists of a relatively narrow coastal belt of less than 400 meters elevation, extending some 80 kilometers or less from the coast, and inland higher plateau country. The main portion of the country consists of plateaus with higher areas rising out of them. These go to 2,000 meters or more.

Rainfall in South West Africa is severely limited. The southern and western portions of the region get 130 mm. (5 inches) OR LESS of rain annually. The central region gets from 250-500 mm (10-20 inches) or less. Few areas in South

West get enough rain for farming and irrigation is possible only in a narrow belt along the Orange River.

Two deserts occur in South West. The Namib Desert along the Atlantic coast is caused by the cold Benguela current. It is an absolute desert. Annual rainfall is from effectively nothing to about 3 inches where grazing is again possible. The Kalahari Desert or perhaps better, the Kalahari sand velt, covers much of South West. This is not a true desert but approaches that condition. Between the Namib and Kalahari is a vast region perhaps best referred to as semi-desert.

This low annual rainfall indicates at once that the region must be pastoral, as in fact it is. The area of the so-called "Police Zone" where most all of the white "farmers" live has been divided into farms considered to be economic units. These units may contain a hundred square miles of land, more or less. The owner may not subdivide nor may he overgraze his lands.

Cattle or sheep are grown, depending somewhat on the farmer's preference and the rain of the particular region.

The pasture plants of the region consist of a number of grasses and a few legumes and plants of even less importance. I should think that the most important grass over the whole area were Aristida. In some of the plateau area between Usakos and Okahandja it was the predominant grass. In this region the rainfall was 4-6 inches.

There are several species and varieties of Aristida found in the pasture lands of South West. The taxonomy of these is being worked out presently by Bernard de Whinter, botanist of the Union of South Africa Department of Agriculture.

Collection of these pasture plants, principally grasses from South West should

be worthwhile. April, May and June would seem to be the collecting time indicated. This period would also be the time to work southward into the Union of South Africa.

Grass from this region should do well in our southwest and in Texas. They should be adapted also to the badly overgrazed ranges of Durango and San Luis Potosí.

Asparagus: Wild species were collected in many places. They were seen growing abundantly in regions of 80-100 inches of rain annually down to a region in South West Africa with but 4 inches.

Brachiaria: The Institut National pour l'Etude Agronomique du Congo Belge, Yangambi station, has been doing some work on the species of Brachiaria native to the Congo. Three species are being grown there as pasture grasses and a fourth under observation.

1. Brachiaria ruziziensis - Is used as a pasture plant in wet region (to 2,000 mm. of rain) and in the drier savannas. Propagation is by seeds and rhizomes.

2. Brachiaria eminii - Is a good producer and the best pasture plant for wet regions and is native in the savanna country. It should be tried in the savannas of our southeast where it is warm and moist.

3. Brachiaria brizantha - African. It is a fair pasture plant. Several ecotypes exist.

4. Brachiaria mutica - Is used in humid situations. A cultural variety called "lapore" is best.

Uses: It is suggested that Brachiaria may prove of value as a pasture for cattle along the wetter part of the Gulf Coast. They might also be tested in Puerto Rico and in Hawaii. I brought some seed, additional may be obtained in the Congo from the above mentioned institute.

Citropsis: There are several species of Citropsis in the Congo. Due to special interest in these, as possibly nematode resistant rootstocks, we made special effort to get propagating material of these. Citropsis latialata bud-wood was collected at the Botanical Garden in Kisantu.

Wild material was collected at Yangambi in the Congo basin of two species. One was Citropsis articulata and the other C. gabunensis. Both seeds and wood of the latter were sent. No bud-wood survived of these three collections.

These species of Citropsis are all small and the bark thin and tight. I do not think that any of the species seen have potential as stocks for citrus.

Citrullus vulgaris: Seeds were collected from a "sweet" wild kind in Sénégála. This is "encouraged" there as a source of water for livestock. Quite a lot of it was seen, the fruits round and perhaps to 30 cm. in diameter.

Seed was collected of the "bitter" kind twice in South West Africa. Fruits to 10-15 cm. in diameter, round. The Bushmen use them as a source of water in the desert. The fruits are put into the fire until the tissue is killed (only) then when the water will separate out and is potable.

Coffea: This crops is being actively studied at several places. The INÉAC has quite a lot of research in progress. The Mulungu Station in the coffee zone near Lake Kivu is of outstanding importance. Use of coffee as a "family crop" is being studied carefully at INÉAC's Rubona station in Ruanda Urundi. We travelled through much coffee land and saw crops equal or better than any ever seen by me in tropical America. There is much potential coffee land still available. Coffee growers problem is expensive transport to the sea.

Crotalaria: Crotalaria is one of the large genera of the Leguminosae in Africa.

We collected many kinds but in the region where there were most species most did not yet have mature seeds. Kinds collected have potentials for green manure, pasture, cover crops, and two or three were good enough to be of ornamental value. We noticed that the fruits of Crotalaria were quite often attack by insects. Ants often use the pods as shelter.

Cynodon: Several types of Cynodon were found and collected. None seemed to be outstanding.

Glycine: Was desired but only one species was found, not closely related to Soya.

Leguminosae (wide sense): Because of interest in legumes as potential sources of gums and other products; and as forage plants many were collected, in fact most all legumes having seed were collected.

Musa: The Congolese and Ruanda people grow a banana with black (or almost black) stems and petioles. This banana was seen on the equator at 2,100 meters and is commonly seen up to 1,800 meters.

The fruit of this plant is not very good, as bananas go, but the fact that it can be cultivated at these altitudes is of importance.

This plant should be brought into tropical America as a subsistence plant for high elevations.

In eastern Congo most native villages in the mountains are surrounded by plantations of this banana.

Phaseolus: The cultivated beans. Beans are not so prominent or important in the diet in tropical Africa as they are in tropical America. I feel that the potential of this subsistence crops is not being used to the fullest in Africa.

The INÉAC at several places, especially Rubona station near Astrida, Ruanda Urundi, is working on the problem.

Ricinus: Many collections of castor beans were made. Most were from INÉAC stations where special interest is taken in this crop. Some collections were made from spontaneous plants.

Sansevieria: There are a number of species of Sansevieria in Africa. These were desired for use in fiber research.

In Jardin Gillet, the botanical garden at Kisantu, a number of species of Sansevieria had been brought together. Father Callens permitted us to take cuttings of all of these.

In the Katanga region of the Congo we found either two or three species, one with flat leaves, one with cylindrical leaves and one intermediate. A curious association was noticed; the sansevierias were found only on abandoned termite hills.

Two or three more species (perhaps one the same as collected in Katanga) were found in the scrub forest area near Sá da Bandeira, Angola.

The material was mostly roots but leaf cuttings of some were sent.

Sesamum: Sesamum species were desired for use in a breeding program. We found species over most of the region which we covered. How many different species are represented will await growing the seeds out and identification of the material. Possibly seven or eight species are involved. Sesamum was found at about 500 meters elevation near Léopoldville and as high as 1,800 meters near Windhoek, the last near 23 degrees south latitude.

Four species of Sesamum had been reported from west central South West Africa. A special trip was made to this region. Three of the four species were found and

collected, all in low rainfall areas, one near Usakos where there is but 100 mm. (4 inches) of annual rainfall.

Sorghum: Only cultivated sorghums were seen - or ones suspected of being escapes. The most unusual material found was one inflorescence which Gilbert purchased from an African market high in the mountains of Ruanda Urundi. Both spikelets of each pair were fertile in the specimen collected. In Sorghum one spikelet of each pair is usually sessile and fertile while the other is sterile although usually staminate.

. Tephrosia vogelii: Is one of the plants in which there was special interest and of which we made a large number of seed collections. This plant appears to be native of the mountain region of the eastern Belgian Congo. The plant is cultivated at many places in the Congo for use as a fish stupificant, as coffee shade, and in control of erosion.

The altitudinal limits where this Tephrosia is native or at least where it is now spontaneous are between approximately 1,500 to 2,000 meters (5,000-6,500 feet) in the latitude of the equator. We saw and collected the species several times in the savanna region north of the Congo basin below the elevations indicated but only cultivated.

The pygmy people who live in the forest area between Komanda and Beni in the valley of the Semliki River cultivate Tephrosia to use in fishing. Although the plant is commonly cultivated there we saw no spontaneous plants. The elevation is mostly around 500-750 meters.

The optimum elevation for Tephrosia seems to be about 1,800 meters (6,000 feet). There is a large area between Butembo, Bukava and Astrida that is of this altitude.

The greatest concentration of the plant seen was in the vicinity of Kayna on the escarpment west of Lake Edward.

In the same vicinity we collected many species of *Tephrosia*, one of them is *T. aequilata* which is closely allied to *T. vogelii*.

The southmost station at which *Tephrosia vogelii* was seen was near Nova Lisboa, Angola, about 13 degrees south latitude. A single white flowered plant was seen.

Gilbert became expert in spotting *Tephrosia*.

Useful Food Plants Lacking in Africa: There are many tropical food or fruit plants that are missing or rare in Africa even though the "hungry season" extends through the year in some regions. The African probably resists new foods, as do most people. An attempt should be made to introduce some of these plants into Africa, and to secure some of the better varieties of the ones already there. It would doubtless prove worthwhile if INÉAC or Departments of Agriculture elsewhere were to send a man well acquainted with tropical African problems to tropical America for a year to collect things for Africa.

To call to mind some things that were not or but rarely seen and plants of which better kinds might be found: mangos seen were mostly poor; tangerines should be looked into for the drier tropics; American selections of bananas for low wet country are superior to anything seen in Congo; beans of the hundreds of varieties of red kidney beans which do not cook up when boiled; avocados that will grow from sea level to 2,000 meters are available, very few trees and fewer fruits were seen; *Sechium edule* was not seen; *Cucurbita*, both pumpkins and squashes would stand looking into; *Phaseolus coccineus* which should be especially useful for the high

Kivu and the mountains of Ruanda Urundi were not seen, there are many varieties in Guatemala and Costa Rica; Mammea americana was not seen. Certainly a man acquainted with Africa and its food plants would find many things of value in tropical America.

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